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BASIC DATA

Funding:
EU-FP7
(€ 6 million)

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(2013 to 2017)

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THE USE OF ENZYMES IN BROILER AND PIG DIETS CONTAINING LOW SOYA AND VARYING LEVELS OF ENERGY AND AMINO ACIDS

M.E.E. Ball[1], V.E. Beattie[2], H. Hayes[2], P.G. Lawlor[3], A. Torres-Pitarch[3] and E. Magowan[1]

[1]Agri-Food and Biosciences Institute, Hillsborough, BT26 6DR, Northern Ireland
[2]Devenish Nutrition, Lagan House, 19 Clarendon Road, Belfast, BT1 3BG, Northern Ireland
[3] Teagasc, Moorepark, Fermoy, Co Cork, Ireland

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Introduction

- Dried distillers grain solubles (DDGS) and rapeseed meal (RSM) in non-ruminant diets may reduce diet costs and reliance on soyabean meal
- DDGS and RSM shown to reduce performance
- Enzymes may improve performance of lower specification diets
- Lack of information on the use of enzymes in diets containing DDGS and RSM which are formulated to have a lower level of essential nutrients

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Objectives

- To examine effect of phytase and protease in broiler diets containing DDGS and RSM with lower levels of P, Ca and available amino acids
- To examine the effect of protease and xylanase/β-glucanase in pig diets containing DDGS and RSM with lower levels of net energy (NE) and available amino acids

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Broiler Trial

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
    1. Positive control 1 (No DDGS or RSM, no enzymes, adequate P, Ca and aa)
    2. Positive control 2 (RSM, DDGS, no enzymes, adequate P, Ca and aa)

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
    1. Positive control 1 (No DDGS or RSM, no enzymes, adequate P, Ca and aa)
    2. Positive control 2 (RSM, DDGS, no enzymes, adequate P, Ca and aa)
    3. RSM, DDGS, no enzymes, low P and Ca, adequate aa
    4. RSM, DDGS, phytase, low P and Ca, adequate aa

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Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No DDGS or RSM, no enzymes, adequate P, Ca and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate P, Ca and aa)
  3. RSM, DDGS, no enzymes, low P and Ca, adequate aa
  4. RSM, DDGS, phytase, low P and Ca, adequate aa
  5. RSM, DDGS, no enzymes, adequate P and Ca, low aa (3% sparing)
  6. RSM, DDGS, protease, adequate P and Ca, low aa (3% sparing)
  7. RSM, DDGS, protease, adequate P and Ca, low aa (1.5% sparing)

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Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No DDGS or RSM, no enzymes, adequate P, Ca and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate P, Ca and aa)
  3. RSM, DDGS, no enzymes, low P and Ca, adequate aa
  4. RSM, DDGS, phytase, low P and Ca, adequate aa
  5. RSM, DDGS, no enzymes, adequate P and Ca, low aa (3% sparing)
  6. RSM, DDGS, protease, adequate P and Ca, low aa (3% sparing)
  7. RSM, DDGS, protease, adequate P and Ca, low aa (1.5% sparing)
  8. Negative control (RSM, DDGS, no enzymes, low P, Ca and aa)

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Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No DDGS or RSM, no enzymes, adequate P, Ca and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate P, Ca and aa)
  3. RSM, DDGS, no enzymes, low P and Ca, adequate aa
  4. RSM, DDGS, phytase, low P and Ca, adequate aa
  5. RSM, DDGS, no enzymes, adequate P and Ca, low aa (3% sparing)
  6. RSM, DDGS, protease, adequate P and Ca, low aa (3% sparing)
  7. RSM, DDGS, protease, adequate P and Ca, low aa (1.5% sparing)
  8. Negative control (RSM, DDGS, no enzymes, low P, Ca and aa)
  9. RSM, DDGS, phytase, protease, low P, Ca and aa (3% sparing)
  10. RSM, DDGS, phytase, protease, low P, Ca and aa (1.5% sparing)

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Starter diets (0-14d)

	RSM (%)	DDGS (%)	Soya (%)	Av Lys (%)	Av P (%)	Enzyme
1	-	-	24	1.145	0.45	None
2	2.5	3.5	22	1.145	0.45	None
3	2.5	3.5	23	1.145	0.35	None
4	2.5	3.5	23	1.145	0.45	Phytase
5	2.5	3.5	20	1.115	0.45	None
6	2.5	3.5	20	1.145	0.45	Protease
7	2.5	3.5	20	1.145	0.45	Protease
8	2.5	3.5	20	1.115	0.35	None
9	2.5	3.5	20	1.145	0.45	Phytase + protease
10	2.5	3.5	20	1.145	0.45	Phytase + protease

Grower diets (14-21d)

	RSM (%)	DDGS (%)	Soya (%)	Av Lys (%)	Av P (%)	Enzyme
1	-	-	23	1.04	0.4	None
2	5	6	17	1.04	0.4	None
3	5	6	18	1.04	0.3	None
4	5	6	18	1.04	0.4	Phytase
5	5	6	15	1.01	0.4	None
6	5	6	15	1.04	0.4	Protease
7	5	6	15	1.04	0.4	Protease
8	5	6	15	1.01	0.3	None
9	5	6	15	1.04	0.4	Phytase + protease
10	5	6	15	1.04	0.4	Phytase + protease

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Finisher diets (21-35d)

	RSM (%)	DDGS (%)	Soya (%)	Av Lys (%)	Av P (%)	Enzyme
1	-	-	22	0.975	0.38	None
2	7	8	13	0.975	0.38	None
3	7	8	14	0.975	0.28	None
4	7	8	14	0.975	0.38	Phytase
5	7	8	11	0.949	0.38	None
6	7	8	11	0.975	0.38	Protease
7	7	8	11	0.975	0.38	Protease
8	7	8	10	0.949	0.28	None
9	7	8	10	0.975	0.38	Phytase + protease
10	7	8	10	0.975	0.38	Phytase + protease

Experimental details

- 600 male broilers from 0-35d
- Pens of 10 (6 replicates/treatment)
- Feed intake (FI), liveweight gain (LWG) and feed conversion ratio (FCR)
- Starter, grower and finisher periods
- Data analysed by ANOVA
- Polynominal contrasts determined differences between treatments (PC1 vs. PC2, low P, protease, phytase, interaction, 1.5% vs. 3% sparing)

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Results

The effect on performance

	Min-Max	Mean	SEM	Prob
Starter FI (g/d)	34.6-36.9	35.3	1.02	0.713
Starter LWG (g/d)	29.5-32.4	31.0	0.95	0.240
Starter FCR	1.10-1.17	1.14	0.024	0.136
Grower FI (g/d)	90.0-96.0	93.0	1.98	0.542
Grower LWG (g/d)	69.4-75.1	71.9	2.01	0.652
Grower FCR	1.24-1.37	1.30	0.032	0.186

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The effect on performance

	Min-Max	Mean	SEM	P
Finisher FI (g/d)	133.6-148.0	144.1	5.32	0.815
Finisher LWG (g/d)	88.1-98.4	93.6	3.24	0.566
Finisher FCR	1.44-1.70	1.56	0.064	0.189
Overall FI (g/d)	86.0-91.1	90.3	2.51	0.889
Overall LWG (g/d)	61.7-65.9	64.3	1.45	0.446
Overall FCR	1.34-1.48	1.41	0.033	0.141

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- 3% sparing in amino acids resulted in poorer FCR in the starter and overall periods

	3% sparing	1.5% sparing	MS error	P
Starter FCR	1.15	1.10	0.003	0.038
Overall FCR	1.44	1.37	0.006	0.046

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- Contradictory effect of phytase

	+ phytase	- phytase	MS error	P
Grower FCR	1.31	1.24	0.006	0.040
Finisher FCR	1.50	1.65	0.024	0.028

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Conclusions

- RSM and DDGS did not reduce performance
- All diets supplied adequate levels of nutrients
- No significant effect of adding enzymes
- Inconsistent effect of phytase – overall no effect

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Pig Trial

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
    1. Positive control 1 (No RSM or DDGS, no enzymes, adequate NE and aa)
    2. Positive control 2 (RSM, DDGS, no enzymes, adequate NE and aa)

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No RSM or DDGS, no enzymes, adequate NE and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate NE and aa)
  3. RSM, DDGS, no enzymes, adequate NE, low aa (3% sparing)
  4. RSM, DDGS, protease, adequate NE, low aa (3% sparing)

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No RSM or DDGS, no enzymes, adequate NE and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate NE and aa)
  3. RSM, DDGS, no enzymes, adequate NE, low aa (3% sparing)
  4. RSM, DDGS, protease, adequate NE, low aa (3% sparing)
  5. RSM, DDGS, no enzymes, low NE (5%), adequate aa
  6. RSM, DDGS, xylanase/β-glucanase, low NE (5%), adequate aa

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No RSM or DDGS, no enzymes, adequate NE and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate NE and aa)
  3. RSM, DDGS, no enzymes, adequate NE, low aa (3% sparing)
  4. RSM, DDGS, protease, adequate NE, low aa (3% sparing)
  5. RSM, DDGS, no enzymes, low NE (5%), adequate aa
  6. RSM, DDGS, xylanase/β-glucanase, low NE (5%), adequate aa
  7. RSM, DDGS, no enzymes, low NE (5%) low aa (3% sparing)
  8. RSM, DDGS, protease, xylanase/β-glucanase, low NE (5%), low aa (3% sparing)

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Materials and Methods

- Ten diets formulated:
  1. Positive control 1 (No RSM or DDGS, no enzymes, adequate NE and aa)
  2. Positive control 2 (RSM, DDGS, no enzymes, adequate NE and aa)
  3. RSM, DDGS, no enzymes, adequate NE, low aa (3% sparing)
  4. RSM, DDGS, protease, adequate NE, low aa (3% sparing)
  5. RSM, DDGS, no enzymes, low NE (5%), adequate aa
  6. RSM, DDGS, xylanase/β-glucanase, low NE (5%), adequate aa
  7. RSM, DDGS, no enzymes, low NE (5%) low aa (3% sparing)
  8. RSM, DDGS, protease, xylanase/β-glucanase, low NE (5%), low aa (3% sparing)
  9. RSM, DDGS, no enzymes, low NE (10%), low aa (8% sparing)
  10. RSM, DDGS, protease, xylanase/β-glucanase , low NE (10%), low aa (8% sparing)

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Grower diets (7-10 weeks)

	RSM (%)	DDGS (%)	Soya (%)	NE (MJ/kg)	Av Lys (%)	Enzyme
1	-	-	26	10.5	1.14	None
2	5	15	12	10.5	1.14	None
3	5	15	12	10.5	1.11	None
4	5	15	12	10.5	1.14	Protease
5	5	15	11	10.0	1.14	None
6	5	15	11	10.5	1.14	Xylanase/ß-glucanase
7	5	15	12	10.0	1.11	None
8	5	15	12	10.5	1.14	Protease + Xylanase/ß-glucanase
9	3.5	15	12	9.5	1.05	None
10	3.5	15	12	10.5	1.14	Protease + Xylanase/ß-glucanase

Finisher diets (10 weeks-finish)

	RSM (%)	DDGS (%)	Soya (%)	NE (MJ/kg)	Av Lys (%)	Enzyme
1	5	-	17	9.9	0.83	None
2	10	20	-	9.9	0.83	None
3	10	20	-	9.9	0.81	None
4	10	20	-	9.9	0.83	Protease
5	9	20	-	9.4	0.83	None
6	9	20	-	9.9	0.83	Xylanase/ß-glucanase
7	9	20	-	9.4	0.81	None
8	9	20	-	9.9	0.83	Protease + Xylanase/ß-glucanase
9	10	20	-	8.9	0.76	None
10	10	20	-	9.9	0.83	Protease + Xylanase/ß-glucanase

Experimental details

- 800 LWxLR pigs from 7 weeks-finish
- Pens of 10 (8 replicates/treatment)
- Feed intake (FI), liveweight gain (LWG) and feed conversion ratio (FCR)
- 7-10 weeks, 10 weeks-finish and 7 weeks-finish periods
- Data analysed by ANOVA
- Effects of the combinations of different factor levels determined by t-tests on linear contrasts (lowering aa, lowering NE, interaction, lowering aa + protease, lowering aa + xylanase/β-glucanase)

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Results

The effect on FCR

	Min-Max	Mean	SEM	P
7-10wk FCR	1.67-1.98	1.81	0.061	0.018
10wk-finish FCR	2.46-2.59	2.54	0.063	0.858
7wk-finish FCR	2.34-2.50	2.46	0.099	0.293

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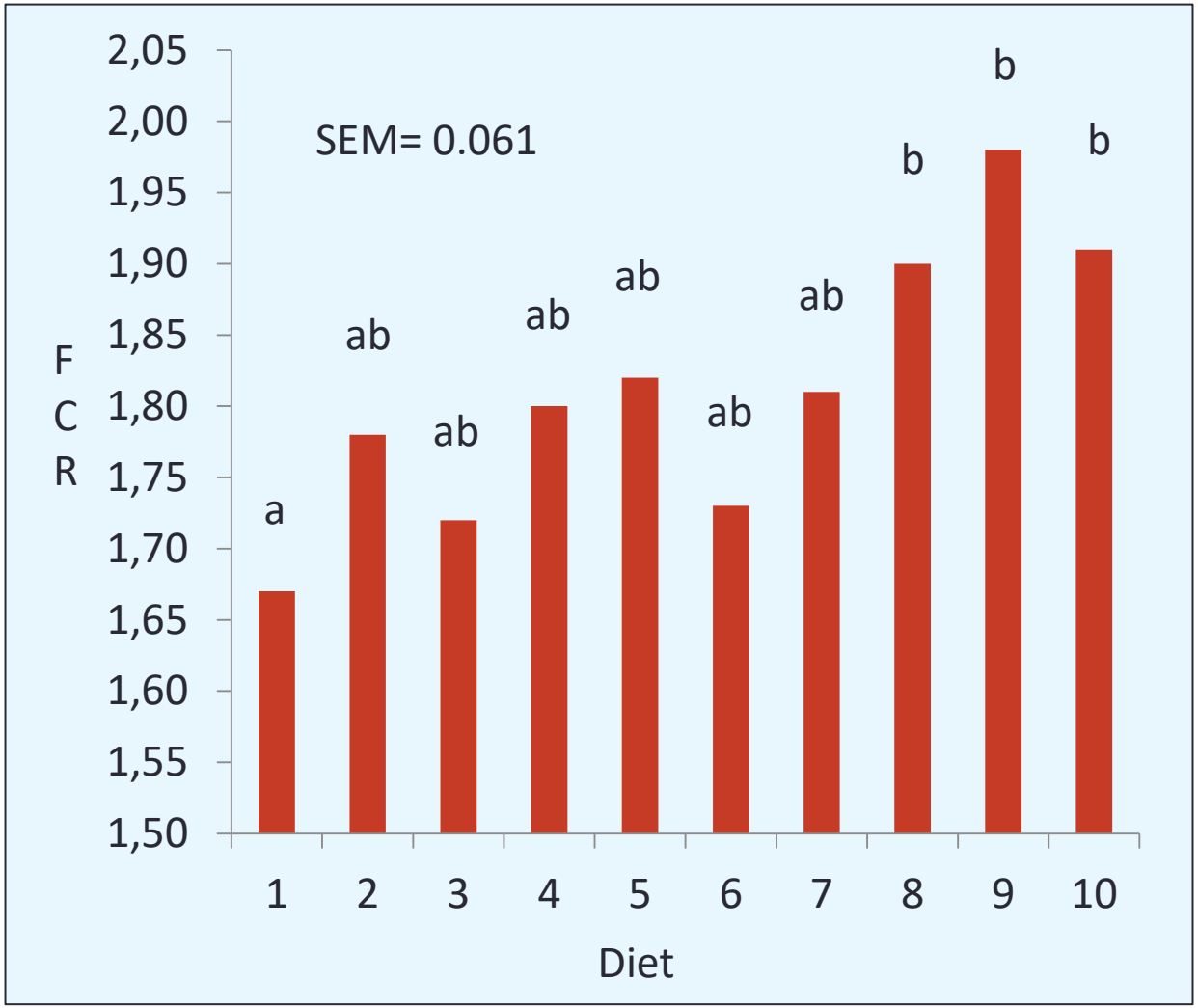
The effect on grower FCR



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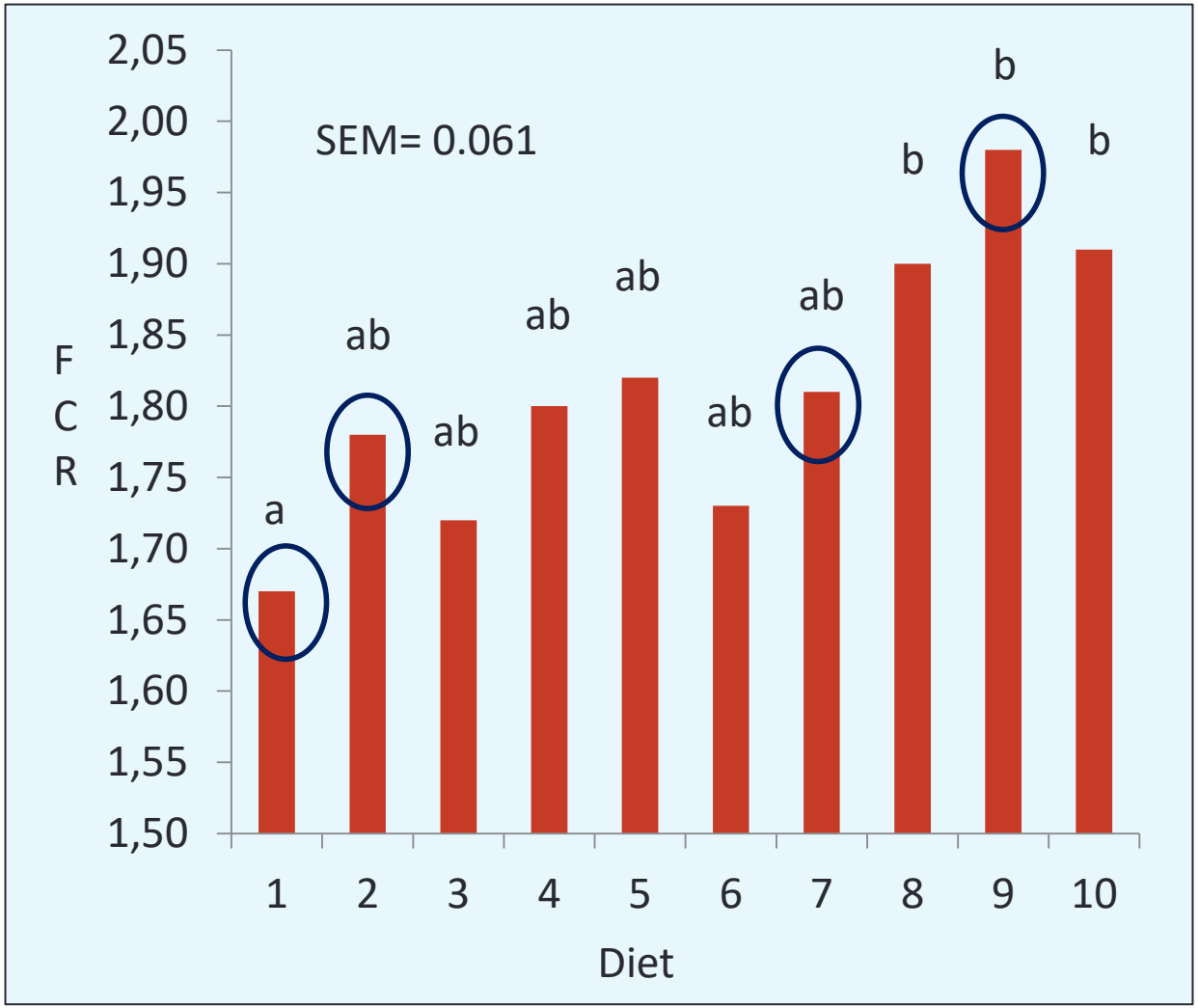
The effect on grower FCR



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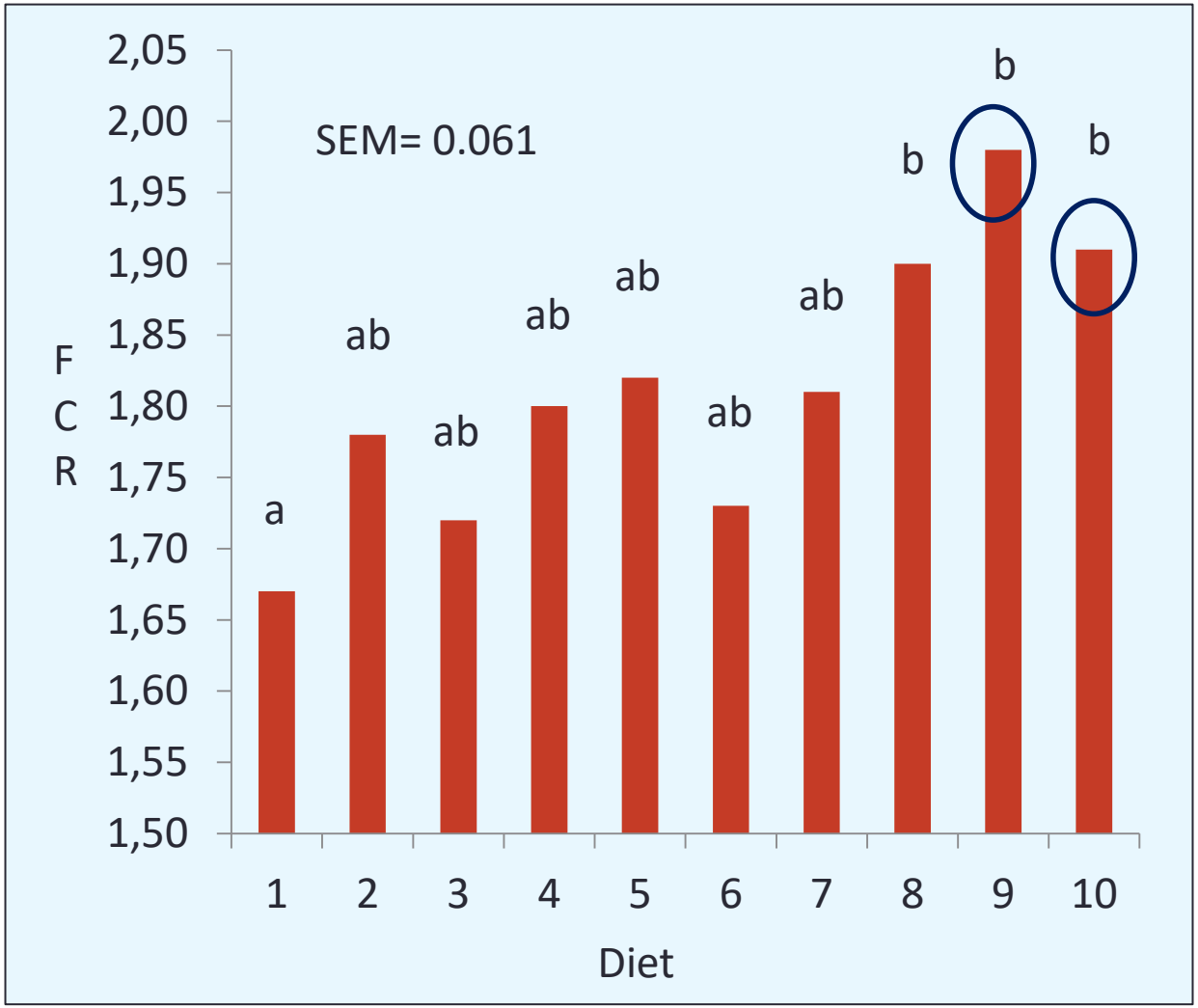
The effect on grower FCR



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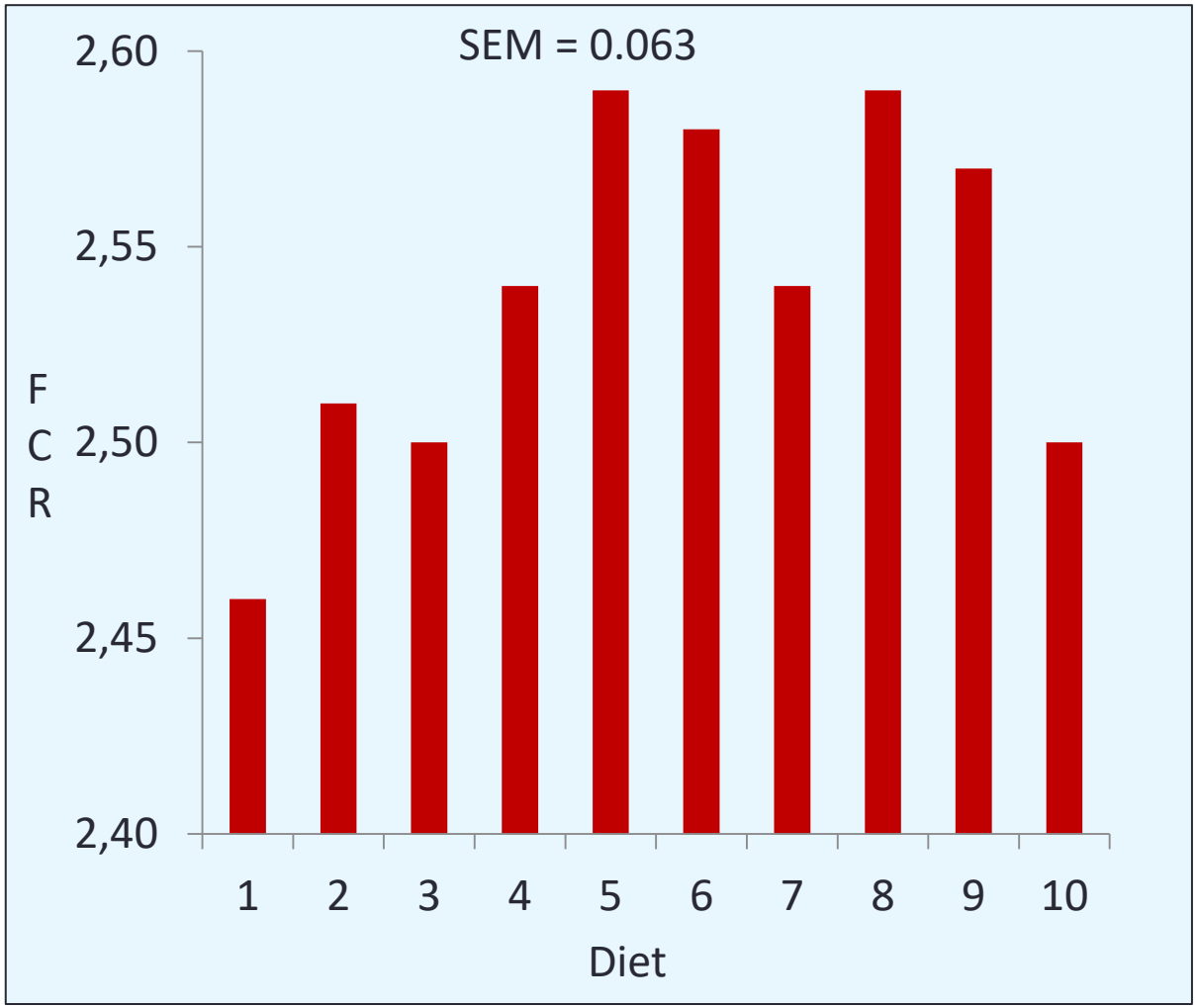
The effect on finisher FCR



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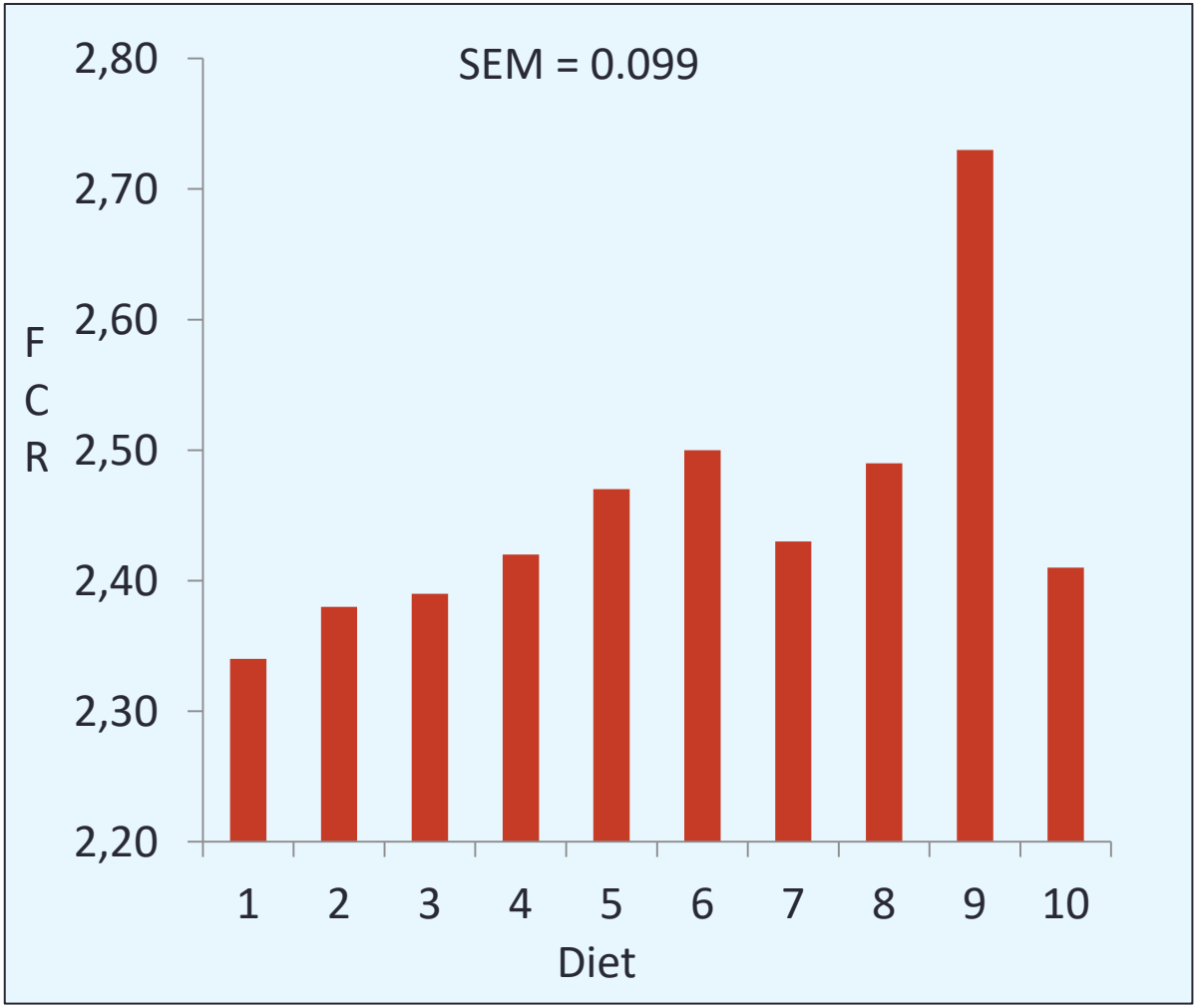
The effect on overall FCR



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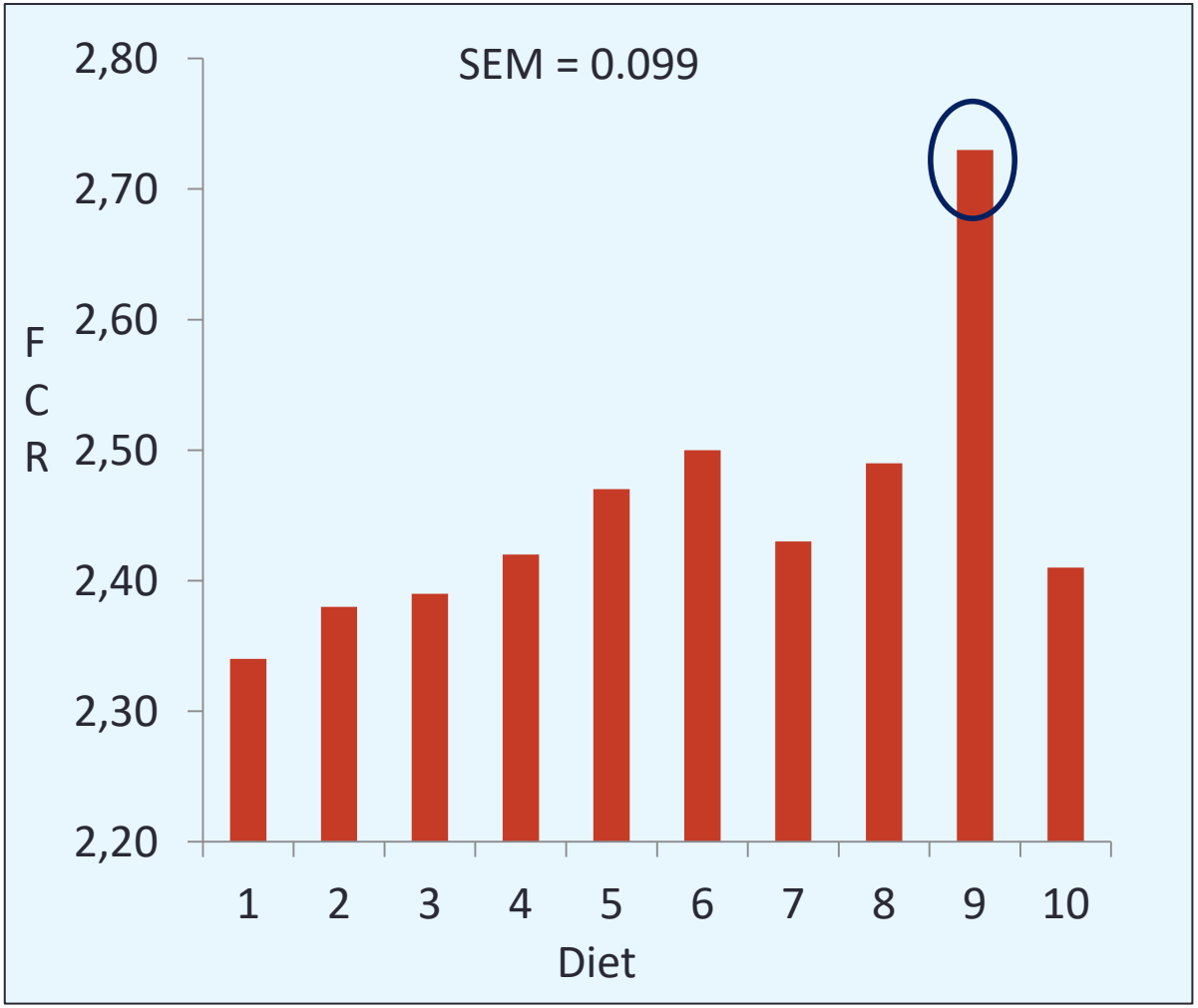
The effect on overall FCR



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- Majority of specific contrasts non-significant
- Reducing NE and aa reduced LWG in 7-10wk period:

	Estimate	SE	t	P
7-10wk LWG (g/d)	91.5	38.1	2.4	0.019

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- Reducing NE by 5% and adding xylanase/ß-glucanase increased FI:

	Estimate	SE	t	P
7wk-finish FI (g/d)	368.8	162.8	2.27	0.027
10wk-finish FI (g/d)	339.1	114.0	2.97	0.004

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Conclusions

- RSM and DDGS did not reduce performance
- Soyabean meal can be removed from finisher pig diets
- Reducing NE and aa resulted in poorer FCR
- Adding xylanase/β-glucanase to diets containing 5% less NE improved intake
- No strong significant effect of enzyme addition on overall performance

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Teagasc trial

A. Torres-Pitarch, U. McCormack, V. Beattie,
E. Magowan, G.E. Gardiner, P.G. Lawlor

Full details to be presented on Thursday 1 September, Session 62, Room 2B at 08.45

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311794.

Objective

Establish the **combination of feed additives** which optimises **feed efficiency** in finisher pigs

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- **DIETARY TREATMENTS:**

1) **Positive control (PC):** exceeds NRC (2012) requirements
2) **Negative control (NC):** basal diet with 5% reduction in energy and amino acid levels.
3) **NC + Heat stable phytase** (Reduced in P and Ca)
4) **NC + Xylanase and β-glucanase complex (Xβ)**
5) **NC + protease**
6) **NC + phytase + protease**
7) **NC + phytase + Xβ** (Reduced in P and Ca)
8) **NC + carbohydrase + protease**
9) **NC + phytase + Xβ + protease** (Reduced in P and Ca)

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Conclusions

- A reduction of 5% in energy and AA on a commercial Irish diet might not be sufficient to see the potential of feed enzymes
- Phytase: The sparing effect for P and Ca was effective
- Xylanase and β-glucanase complex: did not improve FCR
- Protease: may have greater potential to increase feed efficiency in males than in females
- Excellent performance without soya

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- Dr Sally Watson for statistical advice and analysis
- Teagasc

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